3Rs Practices in Asia and the Pacific Islands

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EXECUTIVE SUMMARY

This paper is aimed to scrutinize the current 3Rs practices in Asia and the Pacific Islands. It is also aimed to identify the various positive and negative factors which drive the success and failure of the 3Rs practices. Reduction strategies have been proven effective in Korea and Singapore where waste generation has reduced approximately 22% and 10%, respectively. In countries such as Malaysia, Thailand and the Pacific Islands, the implementation of 3Rs strategies into the existing waste management system have been a real struggle due to lack of public participation, low awareness or indifferent attitude of the community. Thus, introduction of 3Rs practices needs to be handled delicately. In countries like India and Bangladesh, recycling, particularly plastics, is at a very significant rate of 47% and 51%, respectively. Yet, it is mainly the result of economic driver where recycling is the full time profession for the poorer community. On the other hand, Singapore and Japan which recycled 57% and 21%, respectively of the total waste generated in 2008, has been at an increasing climb since the main motive that encouraged recycling practice is environmental awareness and legal factors. The issues, challenges and drivers for 3Rs implementation differed from one country to another and appropriate motivations and specific regulations for 3Rs practice are necessary in order to ensure a sustained 3Rs program in Asia and Pacific Islands.

INTRODUCTION

Sustainable development necessitates the implementation of all possible options to efficiently utilize and manage natural resources. Among the imperative obstacle to tackle is sustainable management of waste. In 2004, global waste generation had exceeded 1.2 trillion kg of MSW (United Nations, 2008). This is an alarming scenario topped with the fact that the annual future generation of MSW is estimated to increase by 7% (United Nations, 2008). The need for sustainable waste management is undeniably crucial to prevent environmental degradation and reduce other impacts of unsustainable

waste management. Thus, waste management hierarchy has been proposed in order to ensure the optimization of waste usage before its final disposal.

Among the most widely adapted is the implementation of Reduce, Reuse and Recycle (3Rs) concept into an integrated waste management system. This concept has taken many forms in the past decade and has been practiced throughout the globe. “Reduce” are activities that leads to the prevention or minimization of wastes. It is the most preferred approach since it is with the objective of reducing or rectifying aspects that generates wastes. It is favored due to its advantage in economy where efficient utilization of raw materials leads to higher productivity, i.e. maximizing profits, greater competitiveness; and the advantage from the environmental aspects, namely the preservation of the environment and natural resources.

On the other hand, “Reuse” can be defined as reutilization of a waste product in its original state either for its original purpose or for a modified purpose. It is the second option preferred after “Reduce”, since it still involved the handling of material called ‘waste’. Reutilization of wastes can be an advantageous strategy since it allows efficient use of waste, reduce loss of resources to disposal, saving of additional expenses, reduction in the ecological-foot print and others. Yet, it also has its disadvantages if additional cost is required to clean or modify the materials prior to its reutilization, and it is also a time-consuming process and less reliable due to wear and tear.

The final “R” implies to “Recycling” which requires processing of waste to produce a new product. It becomes the foundation of resource recovery by which the use of certain materials can be maximized (Ministry of the Environment, Japan, 2008). Though it is placed last in the 3R strategy, recycling is the most widely adapted system due to its simple procedure and effective retrieval strategies where recyclables can be collected and used as raw material in manufacturing processes. In addition, recycling is applicable to a vast range of materials for either the material itself for production of similar product (recycled paper for low grade paper production), other products manufacturing (manufacturing construction materials) or for energy conversion as in anaerobic digestion and composting.

3Rs practices have been proven workable and effective to improve waste management strategy in many parts of the world, namely Japan, Denmark and Germany. Yet, its actual implementation is not as constructive as its theories. Thus, in some parts of the world, particularly in many developing countries, the implementation of 3R is a real challenge and its successful implementation is almost impossible. Many researches had indicated that most sustainable waste management plans require extensive studies before it can be implemented successfully. Similarly for 3Rs practices, its implementations are to be devised according to the local conditions to suit the need of the community (Agamuthu et al, 2009). Therefore, the conditions that drive the practice of 3Rs need to be studied and enhanced in order to promote 3Rs. This paper is aimed to scrutinize the current 3Rs practices in Asia and the Pacific Islands. It is also aimed to identify the various positive and negative factors which drive the success or failure of the 3Rs practices.

Current 3Rs practices in Asia

Reduction strategies have been proven effective in Korea and Singapore where waste generation has reduced approximately 22% and 10%, respectively. In 1995, the Republic of Korea had introduced a volume-based fee system for the treatment or disposal of wastes, and this was aimed to discourage waste generation. The implementation of the "reduce" strategy managed to cut the daily solid waste per capita generation by 22% in 2003 (Ju, 2005). As for Singapore, National Recycling Programme in 2001 sees a reduction of average daily municipal wastes from 7.7×10^6 kg/day in 2001 to 7.0×10^6 kg/day in 2005 (National Environment Agency, Singapore, 2006).

While the "reduce" strategy being so successful in Korea and Singapore, other developing countries in Asia and the Pacific Islands experienced different extreme change. After 2000, many of these countries including India, Malaysia, Indonesia, and China are looking at rapid increase in waste generation. Figure 1 depicts the waste generation scenario in some selected countries in the Asia Pacific region.

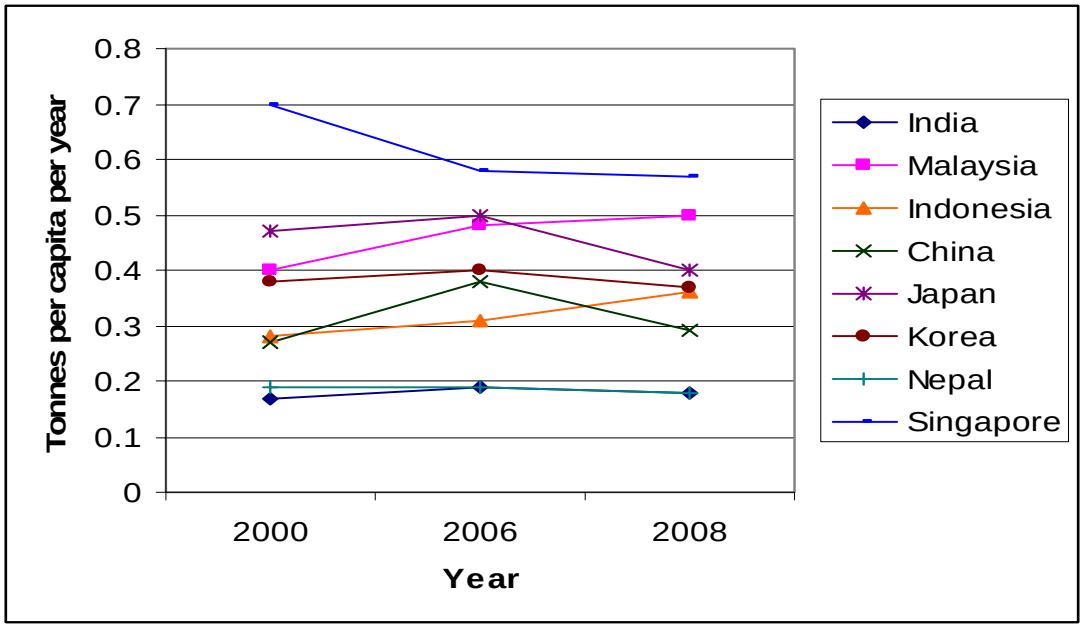

Figure 1 Waste generation trends in selected countries in the Asia Pacific region (Agamuthu et al, 2010).

On average, the daily per capita generation of MSW is 1.3kg in Malaysia, 0.7kg in Vietnam and Laos, 0.4kg in Bangladesh, India and Pakistan, 1.1kg in Japan, and between 0.4-0.7kg in the Pacific Islands (Fauziah and Agamuthu, 2011; Richards, 2010; Tanaka et al, 2010; Troschinetz and Mihelcic, 2008; Nguyen, 2007; World Bank, 2005). The increase in the per capita waste generation differs between countries and is highly dependent on the nations' GDP and socio-economic factors. Thus, reduction in waste generation can significantly affect the efficiency of the waste management system in the country in terms of landfill space, waste disposal cost and the environmental pollution.

Similarly, waste reutilization concept enables more reduction in waste generation in a country. It is proven in Korea and Singapore where the participation of government and private enterprises in the reutilization practices resulted with reduction of waste by approximately 20% (Agamuthu et al, 2009). The possibility of reusing waste is very much dependent on the waste composition of the country where higher percentage of reusable and valuable components allows higher possibility of implementing 3Rs. Figure 2 illustrates the composition of municipal solid waste generated in selected countries in Asia Pacific region.

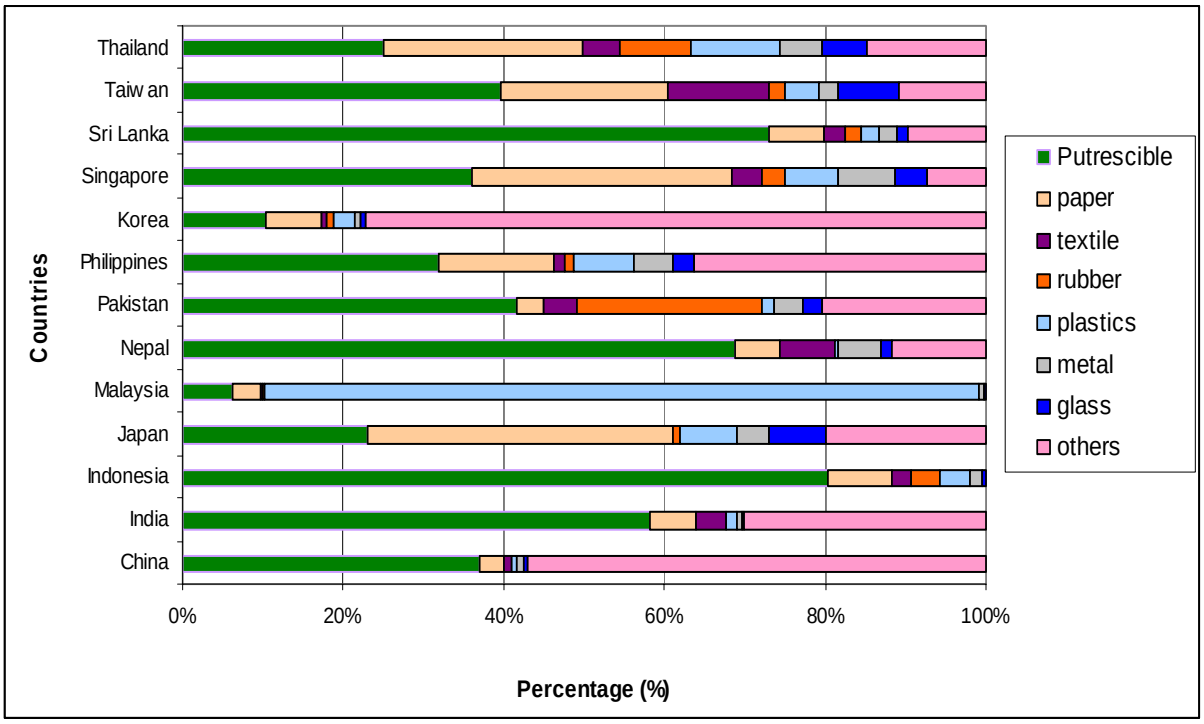

Figure 2 Waste composition generated by selected countries in the Asia Pacific region (Agamuthu et al, 2010).

Figure 2 indicates that on average 80% of the waste generated in Asia Pacific region are recyclables. This includes glass, plastics, metal, paper and others. However, possibility of retrieving these components depend on the available technologies and facilities provided. Malaysian MSW for example, though it comprises of approximately 80% recyclable, retrieving the recyclables is not possible. This is because Malaysian MSW is highly commingled. Additionally, the high moisture content of the waste resulted in the recyclables, namely plastic and paper, to become soiled, which reduced its quality significantly.

Waste sorting at transfer station is not feasible in Malaysia and many other countries in Asia Pacific because of its high cost and impracticality. Generally, the failure in recycling in these countries is mainly due to the lack of source separation. In addition to that, recycling is low due to the low public participation which generally finds recycling an inconvenient practice.

While recycling failed in many countries in this region, countries like Singapore, Japan, Korea, India, Bangladesh and Indonesia have different experience. Recycling practice in these countries is a success which resulted with diversion of waste from disposal option or total loss of resources to landfills. This is because recycling has been the normal practice of the citizen of these nations. While recycling is a habit due to stringent policy and regulation in Singapore, Japan and Korea, it is the livelihood for the urban poor community in India, Bangladesh and Indonesia. To date, India and Bangladesh recycled approximately 47% and 51%, respectively of plastic in particular which gave a very significant rate. Yet, due to the different drives of recycling in these countries rather contradicting trend in the future can be anticipated.

As for Singapore, Japan and Korea, more stringent regulation will be stipulated thus the public and private sector will abide to it resulting with more positive increase in the recycling rate. On the other hand, practicing recycling as the source of income in the poorer countries will result with some shift where improvement in the standard of living will no longer make recycling worth practicing. As the income generation increased, the dependency on other sources particularly recycling will be reduced and eventually diminished. The scenario is observed in many rapidly developing countries like Malaysia and Thailand, where recycling is not being practiced eagerly to generate side-income as it used to be in 1970s. Therefore, this similar trend is expected in India, Bangladesh and Pakistan when the GDP of the country begin to increase. Again, this will eventually result in low rate of recycling in these countries as in Malaysia and Thailand, of which signals the potential failure of 3R implementation.

Issues in 3Rs

In countries such as Malaysia, Thailand and the Pacific Islands such as Samoa, Cook Islands and Tonga, implementation of 3Rs strategies into the existing waste management system have been a real struggle. Generally, this is due to lack of public participation or low awareness and indifferent attitude of the community. Thus, introduction of 3Rs practices needs to be handled delicately. As in the case of Malaysia, campaigns to promote 3Rs have been initiated at the national level as early as 1996. Yet, the recycling rate increased at 5% and has not changed significantly till 2011. Though more campaigns have been launched to promote 3R practices, it fails to improve the rate.

Similar scenario has been observed in many other developing nations in the Asia Pacific regions. The Pacific Islands namely Samoa, Cook Island and Tonga, traditional waste management system discourages effective 3R practice due to the improper waste storage and collection equipment, and lack of appropriate waste recycling facilities (Richards, 2010). Only selective components are efficiently recycled and this depends on the demand and market price. Table 1 summaries the types of recyclables collected in the Pacific Islands.

Table 1 Recyclable materials at selected Pacific Islands (adapted from Richards, 2010).

Recyclables	Pacific Islands	Market for recyclables
Aluminum cans	Cook Islands, Fiji, Guam, Kiribati, Niue, Palau, Samoa, Solomon Islands, Tokelau, Vanuatu	Australia, USA, New Zealand
Scrap metals (ferrous metal)	Cook Islands, Fiji, Niue, Palau, Solomon Islands, Vanuatu	Australia, China, Hong Kong, Mauritius
Paper/ cardboard	Cook Islands, Fiji, Palau	Local, Australia, New Zealand
Glass	Cook Islands, Palau	Local
Plastics	Cook Islands, Fiji, Samoa	Australia
Organic waste (composting)	Cook Islands, Fiji, Palau, Samoa, Tokelau, Tuvalu	Local

The practice of selective recycling is not only occurring in the Pacific Islands but also in many developing Asian countries. In Malaysia, the low price of plastic waste has resulted with its low recycling rate before 2009. However, with the sudden increase in oil price, recycling of plastic became very profitable that plastic is hardly thrown in the waste stream. Another component which is very infamous for recycling is organic matter. The urban parts of China generated MSW which consisted of 41 – 65% organic matter in 2000 that it is estimated that in 2030 the MSW will consist of 51% organic matter (World Bank, 2005). In India approximately 37% of 960 billion kg of MSW generated were organic in nature (Pappu et al., 2007). The impracticality of recycling these component is mainly due to the absence of waste separation. Highly commingled waste are not suitable to undergo anaerobic digestion or composting since the presence of undesirable materials such as plastic and hazardous compound can inhibit the biological processes. Thus, recycling of this vast component is not feasible unless waste separation is integrated into the system.

Additionally, lack of a clear policy and necessary enforcement also is a major issue to be solved in the implementation of 3R. While appropriate legislation and policy regarding 3Rs drive the success of 3R implementation in Singapore, Japan and Korea, its' absence in many developing nation is seen as an imperative factor to consider. While countries like Malaysia has some 'ambiguous' policy regarding recycling the lack of enforcement and non-supportive facilities impede the effectiveness of 3R in Malaysia. To an extent, enforcement of several aspects of 3R legislations has been lax or not enforced in many developing nations in the Asia Pacific region. On the other hand when recycling is being heavily practiced, lack of policy and enforcement has allowed developed nations to abuse it. This is very relevant for the recycling of electronic wastes where developed nations exported these items to be 'recycled' when in actual fact it is meant for disposal in the developing countries like Pakistan. The imports of electronic wastes into Asia, notably India and China are mainly to extracting recyclable materials. Yet, the manual disassembly and crude processes due to unavailable technology pose health and environmental hazard (Mo et al, 2009). The total lack of a policy on e-wastes import and export in India and China resulted with detrimental effect to the environment, since the countries do not employ appropriate technology to process the e-waste (Ragupathy, 2006; Zhou, 2006).

Low initiative from the public to take part in 3R campaigns is another issue which is highlighted in the 3R implementation in the Asia Pacific region. The absence of public participation results in the failure of programs such as 3Rs that require full commitment from the waste generator, namely the public and private sectors. Generally, lack of participation is due to low levels of awareness on the benefits of practicing the 3Rs. Though more than half of Malaysian population claimed to understand the concept of 3R, its practice does not even a quarter of it. This is mainly due to lack of infrastructure in addition to the 'not-bothered' attitude among many individuals (Fauziah et al, 2009).

In many developing countries including Malaysia, India, Bangladesh and China, informal sector plays very significant role in improving the 3R practice namely recycling. Yet, there is little regard for waste pickers and the informal 3R sector that the presence of this group of people is not recognized but considered as a nuisance. While the waste pickers being the main group that separate and retrieve recyclables, their practice is of high risk and pose health hazard. This is so due to the fact that the activities are conducted without proper protective equipment since the majority of them are extremely poor. While legislation is more or less in place to outlaw or reduce scavenging activities, enforcement is quite lax. This allows wastes workers to continue their activities despite their status as unrecognized, trespassers on landfills or illegal collectors of wastes. The fact is that their plight and physical health goes unmonitored, despite their contribution to the 3Rs, especially recycling. In Hanoi (Vietnam), this informal group was reported to divert an estimated 22% of the waste generated in the city (World Bank, 2004).

Challenges in 3Rs Implementation

Issues that rise from many developing nations in the Asia Pacific region have impeded the success of the implementation of the 3Rs. Therefore, in order to overcome these obstacles, these issues need to be faced as the challenges to ensure successful implementation of 3Rs practices. Table 1 summaries the challenges faced by many countries in Asia Pacific region when it comes to the implementation of a successful 3Rs strategy.

Table 1: Issues and challenges of 3Rs implementation in Asia Pacific countries.

Issues	**Challenges**	
	Developed Nations	*Developing Nations*
Population growth	▪ Increase in waste generation. ▪ Improvement in waste management technology	▪ Increase in waste generation ▪ Higher waste complexity ▪ Premature closure of disposal sites ▪ Larger number of waste pickers
Policy implementation	▪ Stringent regulations ▪ Effective	▪ Implementation of adapted policy

		▪ Lack of enforcement ▪ Ineffective ▪ Illegal activities
Changes in waste composition	▪ Introduction of suitable approaches such as, incineration, composting, pyrolysis etc.	▪ Failure in existing waste management system. ▪ Disturb the waste management facilities.
Public participation	▪ High due to high awareness ▪ Active participation- daily habits	▪ Low due to low awareness ▪ Indifferent habits and refusal to change current habits. ▪ Retaliate with illegal waste disposal

	Developed Nations	*Developing Nations*
Informal recycling such as scavenger etc.	▪ Absence due to safety and hygiene factors.	▪ An importance aspect that promote recycling ▪ Unavoidable due to economic drivers. ▪ Number will increase with non-improved nations' GDP ▪ Health concern
Recycling strategies	▪ Practical , inline with governmental policy	▪ Mainly white papers and not applicable for the implementation to the current waste management system.
Existing waste management system	▪ Promote 3Rs	▪ Mainly serve to dispose waste.

Drivers of the 3Rs success

Mainly, four factors are involved which drive the success of 3Rs implementation in the countries like Singapore, Korea and Japan. These include human drivers, economic drivers, institutional drivers and the environment driver (Agamuthu et al, 2009).

Human driver involves population growth factor which resulted in increased waste generation. Additionally, human drivers also include human wellbeing and human attentiveness towards the practice of 3Rs. The increase in population resulted in an increase in waste generation which indirectly caused higher pollution to the environment. In order to ensure human wellbeing, the third human driver namely human awareness is essential. This is due to the concern and need to ensure that human is maintained in a clean and comfortable environment. Therefore, in the sense of 3Rs practice the underlying contributor of human driver basically would result in voluntary participation

among public and private sectors. It is generally due to the awareness to ensure that pollution i.e. waste generated, can be minimized. This is seen in Singapore, Japan and Korea, where 3Rs practice is high due to the high participation in 3Rs activities. On the other hand, lack of human drivers as seen in Malaysia, Thailand and many Pacific Islands resulted with failure in 3Rs implementation. Therefore, this issue needs to be tackled via dissemination of information on the importance of 3Rs practices. It is achievable through education and campaign to create awareness, thus would create positive response in cooperating and participating in 3R activities.

Other important drivers for the implementation of 3Rs practice are economic drivers and environmental drivers. Economic driver implies to funding availability and the economic encouragement to participate in 3Rs. This is very crucial as to ensure that participant in the 3Rs activities will benefits from their participation either from good market price of recyclables or other economic incentives. This strategy is proven effective in Japan where returning of plastic bottles for recycling will be awarded with small amount of money i.e. returned deposit. Similar scenario is also practiced in Singapore and Korea. Additionally, economically developed countries (e.g. Japan, Singapore and the Republic of Korea) also stressed on the importance of environmental driver. This is particularly effective when the countries have realistic issue of lack of natural resources and land. While in countries where limited land-space is not an issue, environmental driver seems ineffective which result in the absence of 3Rs practice. Thus, wastes generated are totally landfilled without any prior treatment to retrieve the resources, as observed in Malaysia.

The Institutional driver encompasses legislative activities, research and development activities and businesses. Businesses contribute to a 3R campaign by practicing components of the 3Rs, where applicable. This is especially useful when businesses offer “take-back programs”, where specialized solid wastes (discarded mobile phones, empty printer/toner cartridges or used computers) can be returned to the manufacturer at no charge. These wastes could be reused or recycled for raw materials. By-laws on recycling are essential and it has positive effect on 3rs as seen in Japan and Korea. Regulations on extended producer responsibility (EPR) will reduce industrial and packaging waste.

CONCLUSION

In conclusion, current 3Rs practices in Asia and the Pacific Islands differ from one country to the other. While it is successful in some countries namely those economically developed nations such as Korea, Japan and Singapore, it is almost insignificant in other developing nations. Positive factors that drive towards the success of 3Rs implementation include appropriate human attitude and the economic drivers, strengthened with suitable directive and legislation. Negative factors on the other hand are the lack of human attentiveness, discouraging economic scenario and absence of appropriate regulations pertaining to 3Rs practice. Thus, improvement to amend these negative factors is very crucial to ensure that implementation of 3Rs in Asia and Pacific Island can be sustainable in the near future.

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